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IS INTELLIGENCE

September 11, 1989

John R. Huizenga
Energy Research Advisory Board to the
United States Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Mr. Huizenga:

Re: Information for ERAB Panel on Cold Fusion

Your letter dated 9 August 1989 seeks information regarding electrolytic cells using solutions of LiOD in D_2O. We have done such experiments at BYU this summer in cells built and operated by Profs. W. Pitt and J. Harb. The mass inside each cell is isolated from the outside environment. Information is attached regarding these experiments and others performed by BYU researchers. None show evidence for tritium or "excess heat" production.

The cells described in our Nature paper (Nature **338**: 737, April 27, 1989) did not involve LiOD but rather an acidic solution including various metal salts. A recent paper submitted to the Journal of Fusion Energy for the Sante Fe Workshop on Cold Fusion Phenomena (attached) provides additional information regarding these electrolytic cells. Figure 1 displays an SEM photomicrograph taken by John Hack of Yale University of the fused titanium material used in the BYU cells. We have not looked for tritium production in these cells. We have, however, seen evidence for 2.5 MeV neutron production as described in the attached paper. Similar results were obtained in an experiment conducted in cooperation with Italian colleagues in the Gran Sasso Laboratory in Italy (to be published in Il Nuovo Cimento).

Evidence for neutron production in both electrolytic cells and deuterium-gas charging experiments has also been found in experiments conducted jointly with Howard Menlove and associates at the Los Alamos National Laboratory (see attached paper, submitted to Nature). The LANL/BYU collaboration was established during a visit by Steven Jones to LANL in April 1989. During the visit, Jones encouraged the use of deuterium-charging techniques which had been used at BYU since 1986, but without cooling the samples. The cooling approach was started by Scaramuzzi in Italy.

The LANL/BYU experiments have shown that neutron bursts occur during warm-up from liquid nitrogen temperatures, with the highest frequency of bursting at approximately

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LA-UR 89-1974 (Rev.

MEASUREMENT OF NEUTRON EMISSION FROM Ti AND Pd IN PRESSURIZED D_2 GAS AND D_2O ELECTROLYSIS CELLS*

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ABSTRACT

We have measured neutron emission from cylinders of pressurized D_2 gas mixed with various forms of Pd and Ti metal. For some of the cases, the Ti was coated with a surface layer of Pd. The gas pressure ranged from 7 atm to 80 atm, and the Ti loadings ranged from 20 g to 200 g. Experiments also have been performed for D_2O electrolysis samples. The neutrons were measured using high-efficiency cavity-type detectors containing ^3He tubes. Random neutron emissions were observed as well as time-correlated neutron bursts. The time spread in an individual burst was less than 100 μs. For most of the samples, the neutron emissions were observed after the cylinders had cooled to liquid nitrogen temperature and were warming to room temperature. The bursts occurred about 40 m into the warm-up phase, and the random emission occurred for at least 17 h after the sample reached room temperature. The burst cycle could only be repeated a few times before neutron emission ceased. The neutron emission rates were very low and the 17-h random emission rate was 0.05-0.2 n/s; however, this yield was still highly significant. The instantaneous neutron bursts were more dramatic with yields several orders of magnitude above the coincidence background rates.

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*Work supported by the US Department of Energy, Office of Safeguards and Security.

COLD NUCLEAR FUSION IN CONDENSED MATTER: RECENT RESULTS AND OPEN QUESTIONS

Steven E. Jones
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Abstract

We have observed clear signatures for neutron emission during deuteron infusion into metals, implying the occurrence of nuclear fusion in condensed matter near room temperature. The low-level cold fusion phenomenon has been demonstrated in collaborative experiments at Brigham Young University, at the Gran Sasso laboratory in Italy, and at the Los Alamos National Laboratory. We have shown that cold fusion can be induced in metals using both electrochemical and variational temperature/pressure means to generate non-equilibrium conditions. Observed average neutron emission rates are approximately 0.04 - 0.4 n°/s.

Current efforts focus on trying to understand and control the cold fusion phenomenon. In particular, we wish to understand the correlation of fusion yields with parameters such as hydrogen/metal ion ratio, pressure (induced, for example, by electrical field or gas pressure or mechanical pressure), temperature variation, hydride phase changes, and surface conditions (e.g., a palladium coating on titanium). We want to know if the fusion arises due to the close proximity of the deuterons in the lattice (piezonuclear fusion), or rather from "microscopic hot fusion" accompanying strong electric fields at propagating cracks in the hydride. The latter interpretation would imply neutron emission in bursts. Our experiments show clear evidence for emission of $\sim 10^2$ neutrons in bursts lasting $< 50 \mu s$, although random neutron-singles emissions were also observed. Experiments now underway to compare the d-d, p-d, and d-t fusion rates will be important to a consistent description of the new phenomenon. Careful scrutiny of this effect could increase our understanding of heat, helium-3, and tritium production in the earth and other planets.

For Proceedings of Santa Fe Workshop on Cold Fusion Phenomena,
(Submitted to Journal of Fusion Energy for Proceedings)

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REACTOR MATERIALS DIVISION
System Chemistry & Corrosion Branch

1989 August 28

Prof. John R. Huizenga, Co-Chairman
Panel on Cold Fusion
467 Hutchison Hall
University of Rochester
Rochester, New York 14627
USA

Dear Professor Huizenga:

TRITIUM FROM COLD FUSION

As requested I am enclosing some details of tritium measurements in our cold fusion cells. In all experiments, the quantity of tritium found afterwards was less than or equal to the starting quantity. At this time, we have never observed any heat, voltage or current in our calorimetry cells which have operated up to 4 weeks, with and without arsenic, and with current densities from 150-800 $ma.cm^{-2}$. Details of cells are given in the enclosed paper.

Sincerely yours,

David R. McCracken

D.R. McCracken

DRM:kmk

Encl.

TRITIUM DATA

Starting Material - 99.97% D_2O → 14.7 ± 0.1 $Bq.cm^{-3}$

CELL	DATE	$Bq.cm^{-3}\pm 2$*	$Bq.cm^{-3}\pm 0.1$**
99.97% D_2O		15.7	14.7
2		13	13.4
4		12	12.5
4	89 May 4	11	13.7
5A	89 April 26	11	11.4
5A	89 April 28	14	9.8
5A	89 May 3	14	14.6
99.99% H_2O			0.47±0.01
Calorimeters		14-17	

8-11*** excess tritium <2$Bq.cm^{-3}$

* Tritium lab (S. Bokwa)
** Dosimetric Research Branch
*** Tritium measurements done at Whiteshell Nuclear Research Establishment

Analyses done by liquid scintillation counting after distillation.

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